A. Course Description
This course aims to equip students with numerical methods and algorithms that can be used to solve various science and engineering problems. The topics include error analysis, matrices, finding roots of equations, curve fitting, and numerical integration and differentiation. This course involves computer programming in C/C++.

Prerequisite: CE 21, CE 22, MA 21

B. Course Objectives
In this course students must be able to implement various numerical methods and algorithms.

C. Course Outline and Timeframe
- Introduction to Numerical Methods and Computation (1 to 6 hrs)
- Solution of Equations by Iteration (3 to 6 hrs)
- Splines and Interpolation (1 to 9 hrs)
- Numerical Integration and Differentiation (1 to 6 hrs)
- Numerical Methods for Linear Systems of Equations (1 to 9 hrs)
- Curve Fitting: Method of Least Squares (1 to 6 hrs)
- Matrix Eigenvalues (1 to 6 hrs)
- Numerical Methods for Differential Equations (6 to 12 hrs)

Special Topics (may be covered anytime)

Note: The course outline and timeframe are subject to change. The major requirements of the course consist of programming projects.

D. Required Readings

E. Suggested Readings

F. Course Requirements
The major requirements of the course are programming projects. Other requirements include various homework, seatwork, short programming exercises and other activities.
G. Grading System

The class standing is determined as

\[ CS = 0.7 \text{ Proj} + 0.3 \text{ Part} \]

where

Proj is the average project grade in the range \([0, 100]\), and
Part is the participation grade in the range \([0, 100]\).

Each course project is rated according to the following system (based on the official grading system of the university):

- **A**  Fulfillment of the requirements set for the project to a high degree of academic performance as shown by both an intelligent grasp and superior critical appreciation of the subject matter. Project grade in the range \([92, 100]\).
- **B**  Fulfillment of the requirements set for the project to a degree above satisfactory performance as shown by both an intelligent grasp and rudimentary critical appreciation of the subject matter. Project grade in the range \([77, 86]\).
- **C**  Satisfactory fulfillment of the requirements set for the project as shown by a fairly intelligent grasp of the subject matter. Project grade in the range \([60, 69]\).
- **D**  Passing fulfillment of the minimum requirements set for the project. Project grade in the range \([50, 60]\).
- **F**  Failure: Non-fulfillment of the minimum project requirements. Project grade in the range \([0, 50]\).

The grades of C+ —project grade in the range \([69, 77]\)— and B+ —project grade in the range \([86, 92]\)— are given for those inevitable borderline cases which, in the professor's estimation, do not merit the higher grade and at the same time definitely deserve better than the lower grade or mark.

The participation grade covers class participation, homework, quizzes and other day-to-day class activities.

A student's participation grade shall be computed as

\[ P = \max \left( P_{\min}, \min \left( P_{\max}, P_{\min} + (P_{\max} - P_{\min}) \left( \frac{P_{\text{cred}}}{M_P} \right)^{\frac{1}{C_P}} \right) \right) \]

where

\( P_{\text{cred}} \) is the sum of all participation credits earned by the student,
\( M_P \) is the maximum value of \( P_{\text{cred}} \) over all students in the class,
\( P_{\min} \) is initially set to 0,
\( P_{\max} \) is initially set to 100, and
\( C_P \) is a “curving parameter” initially set to 1.

\( P_{\text{cred}} \) is changed to 0 in the unfortunate case where it turns out to be negative at the end of the semester. The instructor may change the values of \( P_{\min}, P_{\max} \) and \( C_P \).
On a given class day, a student who is in class earns participation credits given by

\[ P_{\text{daily}} = PF \cdot RF \cdot \left( \sum_{i=0}^{N-1} \left( \frac{1}{2} \right)^i S_i \right) + P_{\text{raw}} + B_{\text{raw}} - D_{\text{raw}} \]

where:
- \( PF \) is a punctuality factor set to 1.0 if student was in class at the start of the period and set to 0.8 otherwise;
- \( RF \) is a recovery factor set to 1.5 if the value of \( MP \) is 200 or more as of the previous class day and a student's participation class standing (as of the previous class day) is below 50 or below the class average, and set to 1.0 otherwise;
- \( N \) is the number of homework submitted by a student, and the \( S_i \) are the homework scores sorted from largest to smallest, with each homework submitted being graded over 10 points.
- \( P_{\text{raw}} \) are raw participation points given for recitation, quizzes, seatwork, class participation and various contributions to class discussion
- \( B_{\text{raw}} \) are raw bonus points earned
- \( D_{\text{raw}} \) are raw participation demerits given for offences such as, but not limited to, disturbing class discussion, refusal to participate in class activities and violation of the dress code.

A student who is absent earns no participation points.

The final grade (FG) will be determined from the class standing (CS) as follows: FG = F if CS < 50, D if 50 \( \leq \) CS < 60, C if 60 \( \leq \) CS < 69, C+ if 69 \( \leq \) CS < 77, B if 77 \( \leq \) CS < 86, B+ if 86 \( \leq \) CS < 92, A if 92 \( \leq \) CS.

**H. Classroom Policies**

**H.1. Attendance**

Students who arrive after the class period has started are considered late. Students who have not come in by the time attendance is checked will be marked absent. Students who arrive late and/or after attendance has been checked are responsible for ensuring that they are marked late, rather than absent, by informing the instructor by the end of the period that they came in late. They may be marked absent if they fail to do so. Lateness is not considered a cut.

Students who have exceeded the allowed number of cuts shall be given a grade of W, and shall be barred from class for the rest of the semester. Dean's Listers are NOT allowed unlimited cuts.

**H.2. Attire**

Students are expected to dress decently and appropriately. Shorts and skirts that are too short are not appropriate attire. These shall be considered too short if the person would be touching skin rather than cloth when standing up with hands hanging down. Slippers and similar footwear, including those that are not strapped at the back of the heel, are not appropriate attire. Students wearing inappropriate attire may be barred from class, denied participation points and/or given participation demerits.
H.3. Homework
All homework should be typeset and printed on short bond paper. No handwritten homework will be accepted. Only those physically present in class may submit homework. Homework must be submitted when called for. Homework may have additional requirements in addition to the printed component. Students should be ready to present their homework in class when called upon to do so. Students who refuse to or cannot present their homework in class will not be given full credit for the homework in question. Homework should cite all relevant references used. Students may submit additional homework at the end of the class period.

Not all homework will be discussed in class. Some homework are assigned because they will not be discussed.

H.4. Projects and Group Work
All programming projects should be done using C/C++. Projects may be done in groups of at most 3 members. Groupmates should change from one project to the next. Except for the first project, one's groupmates in a project may not include any groupmate from the immediately preceding project.

The grading of projects takes into account all available indicators of the merits of the project and what has been learned from the project. Each project may require a project defense. All group members should be present during a project defense. Group members who are absent incur a penalty of 10 points in the project grade. The instructor will select one group member to answer all questions about the project. The group member is selected in such a way that students take turns defending projects from one project to the next. Other group members may answer only if they feel the selected group member is not answering questions properly, in which case the selected group member incurs a penalty of at least 10 points in the project grade.

H.5. Language
This is an English language course. All oral presentations shall be in English. All documents submitted shall be in English.

I. Consultation Hours
130 - 330, Wednesday and Thursday, F-312